burgh, S. C.; 26° at Hohenwald, Nunnelly, and Riddleton, Tenn.; 24° at Hartley, Tex.; 22° at Beaver, Utah; zero at Weatherford Centre, Vt.; 26° at Lexington, Va.; 22° at Seven Pines, W. Va.; 11° at Wausau, Wis., and Camp Pilot Butte, Wyo. At the following named Signal Service stations the temperature was as low or lower than previously reported for October: Portland, Me., eighteen years record, 26°, 2° below minimum of 1886; Fort Smith, Ark., eight years record, 31°, the same as minimum of 1886; Brownsville, Tex., fourteen years record, 49°, the same as minimum of 1879; Oswego, N. Y., nineteen years record, 24°, the same as minimum of 1887; Lava, N. Mex., five years record, 28°, the same as minimum of 1888; Fort McDowell, Ariz., six years record, 38°, the same as minimum of 1886. The lowest temperature previously reported for October was generally noted in the east Gulf states, Ohio Valley and Tennessee, upper and lower lake regions, upper Mississippi and Missouri valleys, extreme northwest, southeastern slope of the Rocky Mountains, and northern plateau region in 1887, in the southern plateau region in 1880, and on the middle Pacific coast in 1881. In districts other than those named the periods of occurrence were irregular.

LIMITS OF FREEZING WEATHER.

The southern and western limits of freezing weather are shown on chart iv by a line traced from the south coast of New England southwestward to central Tennessee, thence northwestward to south-central Illinois, thence west-southwest to extreme southwestern New Mexico, thence northwestward to west-central Oregon, whence it curves eastward over the valley of the Columbia River, and thence northwestward to Puget Sound.

RANGES OF TEMPERATURE.

The greatest and least daily ranges of temperature at regular stations of the Signal Service are given in the table of miscellaneous meteorological data. The greatest monthly ranges occurred from Indian Territory northward over the Valley of the Red River of the North, in the upper Missouri valley, and over portions of the middle and southern plateau region, where they were more than 60°, whence they decreased eastward to less than 30° on the New England coast, southeastward to less than 30° on the Gulf coast, southwestward to less than 30° on the extreme south Pacific coast, and westward to 20° on the extreme north Pacific coast.

The following are some of the extreme monthly ranges:

Greatest.	°	Least.	°
Fort Buford, Dak	74.0	Tatoosh Island, Wash	20.0
Dodge City, Kans	66.0	Key West, Fla	21.0
Taylor's Ranch, Utah	65.0	Nantucket, Mass	27.0
Fort Assinniboine, Mont	68.0	San Diego, Cal	28.0
Saint Vincent, Minn	68.0	Galveston, Tex	29.0

FROST.

Heavy frost, damaging vegetation, was reported as far south as University, Miss., Raleigh, Mount Pleasant, and Monroe, N. C., and Statesburgh, S. C. on the 8th, and at Ashwood, Tenn., and Double Springs, Ala., on the 31st. Light frost was reported in extreme south-central Georgia on the 8th, 9th, and 15th; in extreme southern Alabama and Mississippi on the 8th; in extreme southern Louisiana on the 27th and 28th; in central Texas as far south as the thirtieth parallel on the 27th; in New Mexico as far south as Fort Stanton on the 18th and 23d, and Lava on the 30th; in Arizona as far south as Tucson on the 30th and 31st; in California as far south as Jolon on the 9th, and Keeler on the 26th; at Roseburgh, Oregon, on the 15th; in extreme south-central Oregon on the 12th, 28th, and 31st; in western Oregon generally on the 15th; and in northwestern Washington on the 15th and 16th. The occurrence of killing frost in the south Atlantic states was about one week earlier, and in northern Mississippi about two weeks earlier than the average date of first killing frost in those regions, while in northern Alabama and Tennessee it was seasonable. Compared with September, 1889, the southern limit of frost for the current month has extended southward nearly ten degrees on the Atlantic coast; from three to ten degrees in the east Gulf states and the Mississippi Valley; about two degrees in central Texas; remained about the same in New Mexico; about two degrees in Arizona; and about five degrees on the Pacific coast.

For October, 1889, frost was reported south of the fortieth parallel, and in the Pacific coast states, as follows: it was reported in the greatest number of states and territories, twenty-three, on the 9th and 16th; in twenty on the 8th and 17th; in seventeen on the 15th, 28th, and 29th; in sixteen on the 7th; in from nine to fifteen, inclusive, on the 3d, 5th, 6th, 10th, 14th, 18th, 19th, 23d to 27th, inclusive, 30th and 31st; in eight on the 11th and 20th; in from two to seven, inclusive, on the 1st, 2d, 4th, 12th, 13th, 21st, and 22d. There were no dates for which frost was not reported in two or more states or territories south of the fortieth parallel or on the Pacific coast.

Frost was reported on the greatest number of dates, twenty-six, in Pennsylvania; on twenty-three in Illinois and Ohio; nineteen in Nevada and Tennessee; eighteen in Indiana and Missouri; seventeen in Utah and West Virginia; from ten to fifteen, inclusive, in Alabama, Arizona, Colorado, Georgia, Kansas, Kentucky, Maryland, New Mexico, North Carolina, South Carolina, and Virginia; nine in Louisiana and Mississippi; seven in New Jersey; and from two to six, inclusive, in Arkansas, California, Delaware, District of Columbia, Indian Territory, Texas, and Washington. There were no states or territories south of the fortieth parallel or on the Pacific coast, except Florida, in which frost was not reported on two or more dates.

TEMPERATURE OF WATER.

The following table shows the maximum, minimum, and mean water temperature as observed at the harbors of the several stations; the monthly range of water temperature; and the mean temperature of the air for October, 1889:

Stations.	Temperature at bottom.				Mean temperature of air at the station.
	Max.	Min.	Range.	Monthly mean.	
	°	°	°	°	°
Boston, Mass	57.0	48.0	9.0	51.3	48.5
Canby, Fort, Wash	60.5	55.3	5.2	56.9	56.3
Cedar Keys, Fla	84.3	61.0	23.3	74.4	68.8
Charleston, S. C	76.9	64.0	12.9	69.9	64.7
Eastport, Me	52.2	48.7	3.5	50.5	45.8
Galveston, Tex	77.0	70.0	7.0	73.6	72.2
Key West, Fla	84.9	74.0	10.9	79.7	76.8
Nantucket, Mass	63.0	48.5	14.5	55.7	52.0
New York, N. Y	61.9	45.8	16.1	53.9	52.0
Portland, Oregon	63.9	54.0	9.9	57.5	57.2

PRECIPITATION (expressed in inches and hundredths).

The distribution of precipitation over the United States and Canada for October, 1889, as determined from the reports of nearly 2,000 stations, is exhibited on chart iii. In the table of miscellaneous meteorological data the total precipitation and the departure from the normal are given for each Signal Service station. The figures opposite the names of the geographical districts in the columns for precipitation and departure from the normal show, respectively, the averages for the several districts. The normal for any district may be found by adding the departure to the current mean when the precipitation is below the normal and subtracting when above.

The heaviest rainfall of the month fell in north-central Cali-

fornia, in Siskiyou and Shasta counties, where, within a limited area, it exceeded twenty-five inches, the greatest amount, 28.57 inches, being reported at Sims, Shasta Co. The rainfall on the Pacific coast exceeded ten inches along the immediate coast of Oregon, and from the California coast north of the mouth of the Klamath River southeastward over California to about the thirty-ninth parallel; it also amounted to ten inches on the California coast between the thirty-fourth and thirty-fifth parallels. In the plateau regions the precipitation was heaviest in north-central Utah, where it exceeded three inches, and least over southeastern California and southwestern Arizona, where it was generally below one-half inch. On the eastern slope of the Rocky Mountains the precipitation exceeded four inches in western Indian Territory, and in extreme southeastern Wyoming, while within an area extending from north-central Montana northward into the British Possessions no precipitation was reported. In the central valleys the precipitation equalled or exceeded six inches in northeastern Missouri and central Kansas, and no precipitation was reported in areas in western Dakota, west-central and south-central Minnesota, central Texas, and extreme southern Mississippi and Louisiana. East of the Mississippi the precipitation exceeded six inches in south-central New England, on the extreme southeast New England coast, and along the Virginia and Maryland coasts; at Eagle's Mere, Pa., 8.61 inches were reported. In an area in south-central Georgia no rain fell, while at a majority of lake stations in Wisconsin and Minnesota, in the lower Mississippi valley, eastern Texas, central and west-central Florida less than one-half inch of precipitation was reported. The following is the greatest and least precipitation, respectively, reported in the several states and territories: Alabama, 2.30 at Eufaula; 0.03 at Bermuda. Arizona, 2.97 at Tip Top; trace at Saint John's. Arkansas, 5.19 at Ozone; 0.09 at Devall's Bluff. California, 28.57 at Sims; 0.15 at Salton. Colorado, 5.50 at Eagle Farm; trace at Gunnison. Connecticut, 6.56 at Uncasville; 3.55 at Falls Village. Dakota, 1.72 at Spearfish, 0.00 at Wahpeton and Fort A. Lincoln. Florida, 3.16 at Key West; 0.00 at Live Oak. Georgia, 3.12 at Forsyth; 0.00 at several south-central stations. Idaho, 1.84 at Soda Springs; 0.74 at Kootenai. Illinois, 4.63 at Beardstown; 0.14 at Warsaw. Indiana, 3.30 at Rockville; 0.55 at Cannelton. Indian Territory, 5.58 at Fort Supply; 0.93 at Eufaula. Iowa, 2.88 at Keokuk; 0.00 at Eagle Grove. Kansas, 6.75 at Dorrance; 0.02 at Mankato. Kentucky, 5.10 at South Forks; 0.72 at Paducah. Louisiana, 1.50 at Delhi; 0.00 at several southern stations. Maine, 5.86 at Bar Harbor; 1.59 at Farmington. Maryland, 6.25 at Jewell; 2.31 at Cumberland. Massachusetts, 6.21 at Monson; 2.95 at Williamstown. Michigan, 2.35 at Berrien Springs; 0.20 at North Aurelius. Minnesota, 0.34 at Leech Lake and Duluth; 0.00 at several west-central and extreme south-central stations. Mississippi, 0.70 at Agricultural College; 0.00 at several extreme southern stations. Missouri, 6.03 at Wither's Mills; 0.73 at Harrisonville. Montana, 1.27 at Fort Missoula; 0.00 at Fort Shaw. Nebraska, 2.14 at Falls City; trace at Weeping Water. Nevada, 2.41 at Palisade; 0.13 at Wells. New Hampshire, 5.51 at North Chesterfield; 2.96 at Stratford. New Jersey, 5.03 at Tom's River and Hopewell; 1.18 at Valley. New Mexico, 2.55 at Roswell; 0.20 at Coolidge. New York, 5.09 at Boyd's Corners; 0.97 at Schenectady. North Carolina, 4.98 at Southport; 0.45 at Franklin. Ohio, 3.71 at Hanging Rock; 0.50 at Wapakoneta. Oregon, 14.80 at Ellensburgh; 0.80 at Jordan Valley. Pennsylvania, 8.61 at Eagle's Mere; 1.88 at Newcastle. Rhode Island, 5.23 at Narragansett Pier; 3.02 at Kingston. South Carolina, 3.91 at Kirkwood; 0.10 at Port Royal. Tennessee, 2.33 at Charleston; trace at Bolivar. Texas, 4.85 at Hartley; 0.00 at several east-central stations. Utah, 3.85 at Salt Lake City; trace at Ogden. Vermont, 4.75 at Hartland; 2.90 at Strafford. Virginia, 8.17 at Smithfield; 1.69 at Abingdon. Washington, 8.08 at Fort Canby; 0.70 at Fort Walla Walla. West Virginia, 4.54 at Buckhannon; 1.34 at Hinton. Wisconsin, 1.16 at Lincoln; 0.00 at Greenwood and Neillsville. Wyoming, 4.80 at Fort D. A. Russell; 0.32 at Wheatland.

The precipitation for October, 1889, was generally below the normal in the central valleys, the Lake region, the south Atlantic and Gulf states, over the northeastern slope of the Rocky Mountains, the northern part of the northern plateau region, and the extreme eastern parts of the middle and southern plateau regions, and in the British Possessions from the Saint Lawrence Valley to Vancouver Island. The precipitation was generally in excess of the average for the month in New England and the middle Atlantic states, the middle, eastern, and southeastern slopes of the Rocky Mountains, the plateau regions, and on the Pacific coast. The greatest departures below the normal precipitation occurred on the west Gulf coast, where they exceeded five inches, and the most marked excesses in precipitation were reported on the middle and south Pacific coasts, where between the thirty-fourth and forty-first parallels they were more than six inches, and where in the Sacramento Valley they were more than seven inches. Considered by districts the average percentages of the normal precipitation in districts where the precipitation was deficient were about as follows: In the south Atlantic states, 54 per cent.; in the Florida Peninsula, 55 per cent.; east Gulf states, 30 per cent.; west Gulf states, 28 per cent.; Rio Grande Valley, 22 per cent.; Ohio Valley and Tennessee, 55 per cent.; lower lake region, 73 per cent.; upper lake region, 30 per cent.; extreme northwest, 6 per cent.; upper Mississippi valley, 46 per cent.; Missouri Valley, 47 per cent., northeastern slope of the Rocky Mountains, 62 per cent.; southeastern slope of the Rocky Mountains, 75 per cent. In districts where the precipitation was in excess the percentages of the normal were about as follows: New England, 106 per cent.; middle Atlantic states, 143 per cent.; middle-eastern slope of the Rocky Mountains, 202 per cent.; southern plateau region, 107 per cent.; middle plateau region, 158 per cent.; northern plateau region, 194 per cent.; north Pacific coast region, 112 per cent.; middle Pacific coast, 683 per cent.; south Pacific coast over 1,000 per cent. The statement of percentages of precipitation shows that the most marked deficiencies occurred in the extreme northwest, where but 6 per cent. of the normal fell, and that the greatest average excess occurred on the south Pacific coast, where the precipitation was more than ten times greater than the average for October, and on the middle Pacific coast, where it was nearly seven times greater than the normal amount.

A summary of the precipitation in the several districts from January 1 to October 31, 1889, inclusive, shows that in New England the total amount for that period was 40.23, or 0.44 more than the average amount. In the middle Atlantic states the amount, 50.25, was 12.19 in excess of the normal. In the south Atlantic states the total amount was 48.66, giving a deficiency of 0.49. In the Florida Peninsula, 44.40, an excess of 2.69. In the east Gulf states, 43.09, deficiency, 7.34. West Gulf states, 36.72, deficiency, 0.69. Rio Grande Valley, 27.37, excess, 0.33. Ohio Valley and Tennessee, 32.57, deficiency, 7.09. Lower lakes, 24.91, deficiency, 4.58. Upper lakes, 24.78, deficiency, 4.87. Extreme northwest, 11.59, deficiency, 6.30. Upper Mississippi valley, 25.82, deficiency, 6.63. Missouri Valley, 22.68, deficiency, 3.58. Northern slope, 11.68, deficiency, 2.67. Middle slope, 22.71, excess, 1.73. Southern slope, 21.44, deficiency, 1.11. Southern plateau, 8.94, deficiency, 1.69. Middle plateau, 6.85, deficiency, 2.81. Northern plateau, 10.80, deficiency, 3.48. North Pacific coast, 33.72, deficiency, 10.19. Middle Pacific coast, 19.01, excess, 3.81. South Pacific coast, 13.18, excess, 2.06. Among the more notable features shown by this summary are the excessive rainfall in the middle Atlantic states, where the precipitation was in excess of the normal for each month excepting February and August; the deficiency in the Ohio Valley and Tennessee, where the precipitation was less than the normal, excepting in May, June, and September; the marked deficiencies in the Lake region, extreme northwest, and upper Mississippi valley

the continued and marked deficiency in the middle plateau region, where the precipitation was below the normal for each month, excepting October; the large deficiency on the north Pacific coast, where the precipitation was below the normal excepting for May, August, and October; the marked deficiency in precipitation on the middle Pacific coast until October, when the abnormally large rainfall caused an excess of 3.81 for the period; and the rainfall of the south Pacific coast, which had been deficient until the heavy rains of October caused an excess for the ten months of over two inches.

The most notable feature in connection with the precipitation of October, 1889, was the unusually heavy rainfall on the middle and south Pacific coasts, which at stations in west-central and northwestern California was the heaviest ever recorded for the month. At San Francisco the total rainfall for the month was 7.28, an excess of 6.13; at Los Angeles, 6.96, an excess of 6.48; and at Sacramento, 6.02, an excess of 5.20. The reports of the Signal Service observer at San Francisco give the following interesting data in connection with notable excesses and deficiencies in the rainfall of preceding years in that section: In 1849, the October rainfall was 3.14, and the total rainfall for the season of 1849–1850 was 33.10. In October, 1850, no rain fell, and the total fall for the season of 1850–1851 was but 7.40, a most disastrous season to California. In October, 1861, but 0.40 fell, while the rainfall for the season of 1861–1862 was 49.27, the greatest seasonal rainfall in the history of the state. In October, 1876, 3.36 fell, and the total amount for the season of 1876–1877 was 11.04. This was the last really dry season, and thousands of cattle and sheep died from the effects of drought in southern California. At San Francisco the only years in which the October rainfall has approached that of the current month were in 1849, when it was 3.14, and in 1876, when it was 3.36. Since 1849 there have been six years in which no rain fell in October, and two years in which there was but a sprinkle.

DEVIATIONS FROM AVERAGE PRECIPITATION.

The following table shows for certain stations, as reported by voluntary observers, (1) the average precipitation for October for a series of years; (2) the length of record during which the observations have been taken and from which the average has been computed; (3) the total precipitation for October, 1889; (4) the departure of the current month from the average; (5) and the extreme monthly precipitation for October during the period of observation and the years of occurrence:

State and station.	County.	(1) Average for the month of Oct.	(2) Length of record.	(3) Total for Oct., 1889.	(4) Departure from average.	(5) Extreme monthly precipitation for October.			
						Greatest.		Least.	
						Am't.	Year.	Am't.	Year.
Arkansas.		*Inches*	*Years*	*Inches*	*Inches.*	*Inches*		*Inches.*	
Lead Hill	Boone	4.80	8	3.88	—0.92	18.11	1883	0.10	1886
California.									
Sacramento	Sacramento	0.68	53	7.01	+6.33	7.01	1889	0.00	*
Colorado.									
Fort Lyon	Bent	0.52	18	2.46	+1.94	3.75	1870	0.00	*
Connecticut.									
Middletown	Middlesex	3.85	28	5.47	+1.62	14.51	1869	0.89	1868
Florida.									
Merritt's Island	Brevard	6.14	11	1.33	—4.81	11.94	1886	1.33	1889
Georgia.									
Forsyth	Monroe	2.80	15	3.12	+0.32	7.86	1879	0.10	1884
Illinois.									
Peoria	Peoria	2.65	33	2.28	—0.37	5.68	1877	0.70	1860
Riley	McHenry	2.73	38	0.40	—2.33	6.81	1881	0.29	1867
Indiana.									
Logansport	Cass	2.98	13	1.00	—1.98	5.47	1881	1.00	1889
Vevay	Switzerland	2.55	24	2.55	0.00	7.67	1883	0.28	1879
Iowa.									
Cresco	Howard	2.41	18	0.13	—2.28	8.06	1881	0.13	1889
Monticello	Jones	2.89	34	1.25	—1.64	7.21	1881	0.43	1872
Logan	Harrison	2.61	21	0.46	—2.15	6.60	1881	0.46	1889
Kansas.									
Lawrence	Douglas	2.81	23	2.86	+0.05	6.96	1870	0.44	1878
Wellington	Sumner	3.58	10	.....	.....	6.32	1882	1.29	1886
Louisiana.									
Grand Coteau	St. Landry	2.72	6	T.	—2.72	3.83	1884	T.	1889
Maine.									
Gardiner	Kennebec	4.16	49	.....	.....	12.67	1869	0.41	1839

Deviations from average precipitation—Continued.

State and station.	County.	(1) Average for the month of Oct.	(2) Length of record.	(3) Total for Oct., 1889.	(4) Departure from average.	(5) Extreme monthly precipitation for October.			
						Greatest.		Least.	
						Am't.	Year.	Am't.	Year.
Maryland.		*Inches*	*Years*	*Inches*	*Inches.*	*Inches*		*Inches.*	
Cumberland	Allegany	2.19	18	2.84	+0.65	6.30	1871	0.00	1879
Massachusetts.									
Amherst	Hampshire	3.92	54	4.14	+0.22	11.36	1869	1.12	1876
Newburyport	Essex	3.58	11	4.71	+1.13	6.83	1885	0.81	1679
Somerset	Bristol	3.78	17	4.40	+0.62	8.21	1877	1.17	1879
Michigan.									
Kalamazoo	Kalamazoo	3.05	13	1.41	—1.64	6.57	1881	1.29	1886
Thornville	Lapeer	3.03	12	1.28	—1.75	5.34	1884	1.28	1889
Minnesota.									
Minneapolis	Hennepin	2.01	23	0.06	—1.95	4.92	1868	0.06	1889
Montana.									
Fort Shaw	Lewis&Clarke	0.54	20	0.00	—0.54	2.22	1883	0.00	1889
New Hampshire.									
Hanover	Grafton	3.40	48	4.60	+1.20	9.24	1869	0.32	1868
New Jersey.									
Moorestown	Burlington	3.26	26	4.03	+0.77	6.83	1877	0.47	1879
South Orange	Essex	3.52	19	3.46	—0.06	7.19	1877	0.27	1879
New York.									
Cooperstown	Otsego	3.32	35	2.17	—1.15	6.65	1857	0.88	1856
Palermo	Oswego	3.45	35	3.28	—0.17	7.90	1862	0.30	1882
North Carolina.									
Lenoir	Caldwell	3.55	18	0.70	—2.85	9.50	1885	0.70	1889
Ohio.									
N. Lewisburgh	Champaign	2.37	17	0.80	—1.57	5.45	1881	0.45	1887
Wauseon	Fulton	2.72	17	0.93	—1.79	8.92	1881	0.93	'74,'89
Oregon.									
Albany	Linn	3.32	9	6.50	+3.18	7.15	1882	0.97	1887
Eola	Polk	2.95	19	5.10	+2.15	8.01	1876	0.30	1874
Pennsylvania.									
Dyberry	Wayne	3.24	18	3.75	+0.51	6.55	1877	1.23	1882
Grampian Hills	Clearfield	2.87	19	3.21	+0.34	4.74	1873	0.81	1887
Wellsborough	Tioga	3.37	10	5.56	+2.19	7.50	1885	0.79	1882
South Carolina.									
Statesburgh	Sumter	3.08	8	2.81	—0.27	8.15	1887	0.02	1884
Tennessee.									
Austin	Wilson	2.87	20	1.31	—1.56	5.11	1883	0.38	1886
Milan	Gibson	2.37	7	0.81	—1.56	4.72	1883	0.81	1889
Texas.									
New Ulm	Austin	4.01	17	0.69	—3.32	12.44	1881	0.69	1889
Vermont.									
Strafford	Orange	3.29	16	2.90	—0.39	6.80	1873	1.20	1882
Virginia.									
Birdsnest	Northampton	3.26	20	7.50	+4.24	9.25	1872	T.	1884
Wytheville	Wythe	3.04	24	.....	.....	9.40	1860	0.50	1875
Wisconsin.									
Madison	Dane	2.90	20	T.	—2.90	9.12	1881	T.	1889
Washington.									
Fort Townsend	Jefferson	1.99	13	2.18	+0.19	3.58	1875	1.00	1885

*Frequently.

The above table shows that at Sacramento, Cal., fifty-three years record, the rainfall for the current month, 7.01, was the greatest ever reported, the heaviest previous October rainfall, 3.45, being noted in 1876, and that at Merritt's Island, Fla., eleven years record; Logansport, Ind., thirteen years record; Cresco, Iowa, eighteen years record; Harrison, Iowa, twenty-one years record; Grand Coteau, La., six years record; Thornville, Mich., twelve years record; Minneapolis, Minn., twenty-three years record; Fort Shaw, Mont., twenty years record; Lenoir, N. C., eighteen years record; Milan, Tenn., seven years record; New Ulm, Tex., seventeen years record; and Madison, Wis., twenty years record; the precipitation was the least ever reported for October. At Wauseon, Ohio, the precipitation for the current month corresponded with the least previous October precipitation, reported for 1874.

Table of excessive precipitation, October, 1889.

State and station.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
Arkansas.	*Inches.*	*Inches.*		*Inches*	*h. m.*	
Lead Hill	.....	.....	.....	1.35	0 40	12
California.						
American Hill	11.20	3.00	23	.....	.....	.....
Boulder Creek	19.68	.....	.....	.....	.....	.....
Cisco	11.72	.....	.....	.....	.....	.....
Colegrove	.....	3.33	20	.....	.....	.....
Crescent City	13.76	2.58	6	.....	.....	.....
Delta	26.71	.....	.....	.....	.....	.....
Emigrant Gap	11.81	.....	.....	.....	.....	.....
Eureka	.....	3.06	7–8	1.00	0 40	7

Table of excessive precipitation—Continued.

State and station.	Monthly rainfall 10 inches, or more.	Rainfall 2.50 inches, or more, in 24 hours.		Rainfall of 1 inch, or more, in one hour.		
		Amt.	Day.	Amt.	Time.	Day.
California—Continued.	*Inches.*	*Inches.*		*Inches.*	*h. m.*	
Felton	16.91					
Georgetown	10.45					
Glen Ellen	11.26					
Grass Valley	12.49	2.68	22			
Laurel	20.48					
Los Angeles, Cal		3.62	20–21			
Los Gatos (1)	10.85					
Los Gatos (2)	11.89	2.50	20			
Redding	15.13					
Santa Barbara (1)		4.20	20			
Santa Barbara (2)	10.50					
Santa Margarita	10.85					
Sims	28.57					
Sisson	16.45					
Steeles		3.58	23			
Upper Mattole	18.92	3.00	7			
Do		3.12	26			
Connecticut.						
Fort Trumbull		2.61	27			
New London		2.60	27–28			
Florida.						
Jupiter				1.10	1 00	5
Illinois.						
Pana		2.50	21–22			
White Hall		2.67	22			
Kansas.						
Dorrance		2.50	15			
Missouri.						
Steelville				1.25	1 00	31
Wither's Mill		2.50	21–22			
Shelbina		3.10	21			
New Jersey.						
Locktown		2.53	26–27			
New York.						
Hess Road Station		2.50	28			
North Carolina.						
Wilmington		2.96	26–27			
Oregon.						
Bandon	11.80	3.21	8			
Ellensburgh	14.80					
Gardiner	10.23					
Tillamook	11.00					
Pennsylvania.						
Germantown		2.53	26–27			
Seisholtzville		2.63	28			
Swarthmore		2.64	27			
Virginia.						
Birdsnest		4.15	23–24			
Fort Monroe		3.75	23–24			
Norfolk		3.76	23–24			
Smithfield		3.05	23			
Spottsville		3.00	23–24			
West Indies.						
Hamilton (Bermuda)		3.69	8			
Havana (Cuba)		4.59	10			

Excessive precipitation data received too late to be used in general discussion of weather for October, 1889.

California.						
Anderson	12.32	2.75	22			
Mexico.						
La Logia		3.10	12			
West Indies.						
Port au Prince (Hayti)		2.50	2	2.50	1 30	2

Excessive precipitation for September, 1889, *received too late for publication in that month.*

Georgia.						
Quitman		2.50	23			
New Jersey.						
Tom's River		3.35	12			
North Carolina.						
Highlands		3.20	18–19			
Statesville		2.77	23–24			
Texas.						
Weatherford		3.00	10			

EXCESSIVE PRECIPITATION.

Monthly precipitation to equal, or exceed, ten inches was reported at eighteen stations in California and at four stations in Oregon. The heaviest monthly rainfall reported was 28.57, at Sims, Cal.; the monthly rainfall exceeded twenty inches at Delta and Laurel, Cal., and was more than fifteen inches at Boulder Creek, Felton, Redding, Sisson, and Upper Mattole, Cal. The heaviest monthly rainfall in Oregon was 14.80, at Ellensburgh. In October of preceding years precipitation to equal, or exceed, ten inches has been reported most frequently in Florida, where it was noted for sixteen years; in Texas for eleven years; in Louisiana, New Hampshire, New York, North Carolina, Oregon, and Washington for from five to ten years, inclusive; and in Alabama, Arkansas, California, Connecticut, District of Columbia, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Maryland, Massachusetts, Michigan, Mississippi, Missouri, Ohio, Pennsylvania, Rhode Island, South Carolina, Tennessee, Vermont, and Virginia for from one to four years, inclusive. In states and territories other than those named monthly precipitation to equal, or exceed, ten inches has not been reported for October of preceding years. Among heavy rainfalls reported for October of preceding years are 20.03 inches at Mayport, Fla., in 1880, and 29.09 ? at Reidsville, N. C., in 1885. Exclusive of the instances and years cited precipitation to equal, or exceed, fifteen inches has been reported for six years in Texas; for four years in Florida; for two years in Georgia, New York, and Virginia; and for one year in Arkansas, Louisiana, Maine, New Hampshire, and North Carolina.

Precipitation to equal, or exceed, 2.50 inches in twenty-four hours in October, 1889, was reported at the greatest number of stations, ten, in California, from the 6th to 8th, and 20th to 23d; at five stations in Virginia, on the 23d and 24th; at three stations in Pennsylvania, from the 26th to 28th; at two in Connecticut, 27th and 28th; at two in Illinois, 21st and 22d; at two in Missouri, 21st and 22d; at one in Oregon, 8th; at one in Kansas, 15th; at one in New York, 28th; and at one in North Carolina, 26–27th. In states and territories other than those named precipitation to equal, or exceed, 2.50 inches in twenty-four hours was not reported for October, 1889. The heaviest daily rainfalls in the states named were: 4.20 at Santa Barbara, Cal., 20th; 3.62 at Los Angeles, Cal., 20th–21st; 2.61 at Fort Trumbull, Conn., 27th; 2.67 at White Hall, Ill., 22d; 2.50 at Dorrance, Kans., 15th; 3.10, at Shelbina, Mo., 21st; 2.53, at Locktown, N. J., 26–27th; 2.50 at Hess Road Station, N. Y., 28th; 2.96 at Wilmington, N. C., 26–27th; 3.21 at Bandon, Oregon, 8th; 2.64 at Swarthmore, Pa., 27th; 3.05, at Smithfield, Va., 23d; and 4.15 at Birdsnest, Va., 23d–24th. At Hamilton, Bermuda, 3.69 inches fell on the 8th, and at Havana, Cuba, 4.59 inches were reported for the 10th. In October of preceding years precipitation to equal, or exceed, 2.50 inches in twenty-four hours has been most frequently reported in Florida, where it has been noted for fifteen years; in Texas for thirteen years; in Georgia and North Carolina for twelve years; in Louisiana and Pennsylvania for eleven years; in Alabama, Connecticut, Illinois, Indian Territory, Kansas, Maine, Maryland, Massachusetts, Mississippi, Missouri, Nebraska, New Hampshire, New Jersey, New York, Ohio, Rhode Island, South Carolina, and Virginia for from five to ten years, inclusive; in Arkansas, Dakota, District of Columbia, Indiana, Iowa, Kentucky, Michigan, Minnesota, Oregon, Tennessee, Utah, Vermont, Washington, Wisconsin, Delaware, and New Mexico for from one to four years, inclusive. In states and territories other than those named precipitation to equal, or exceed, 2.50 inches in twenty-four hours has not been reported for October of preceding years. Among the heavier October rainfalls reported for this period are: 10.31 at Saint Augustine, Fla., 9–10th, 1880; 13.14 at Fernandina, Fla., 20th–21st, 1882; 9.24 at Key West, Fla., 20th–21st, 1883; 8.20 at Newport, Fla., 8th, 1876; 7.07 at Fort Robinson, Nebr., 23d, 1887; 7.77 at Galveston, Tex., 2d, 1871; 13.08 at Brackettville, Tex., 1st–2d, 1881. Exclusive of the instances and years cited precipitation to equal, or exceed, five inches in twenty-four hours has been reported in Florida and Texas for three years; in Georgia, Louisiana, and North Carolina for two years; and in Maryland, Mississippi, New York, Pennsylvania, South Carolina, Tennessee, Virginia, and Washington for one year. The only reports of precipitation to equal, or exceed, one inch an hour in October, 1889, were: 1.35 in forty minutes, at Lead Hill, Ark., 12th; 1.00 in forty minutes, at Eureka, Cal., 7th; 1.10 in one hour, at Jupiter, Fla., 5th; and 1.25 in one hour, at Steelville, Mo., 31st. Among

the heavier rainfalls reported for one hour or less in October of preceding years are: 1.20 in six minutes, at Brownsville, Tex., 23d, 1884; 1.80 in twenty minutes, at Fort Scott, Kans., 2d, 1881; 1.50 in twenty-five minutes, at Abilene, Tex., 24th, 1885; 2.12 in twenty-five minutes, at Galveston, Tex., 30th, 1877; 2.30 in thirty minutes, at Des Moines, Iowa, 15th, 1880.

MAXIMUM RAINFALLS IN ONE HOUR OR LESS.

The following table is a record of the heaviest rainfalls during October, 1889, for periods of five and ten minutes and one hour, as reported by regular stations of the Signal Service furnished with self-registering gauges:

Station.	Maximum fall in—					
	5 min.	Date.	10 min.	Date.	1 hour.	Date.
	Inch.		*Inch.*		*Inch.*	
Bismarck, Dak.					T.*	
Boston, Mass	0.05	27	0.08	27	0.23	27
Cincinnati, Ohio	0.10	12	0.15	12	0.20	25
Chicago, Ill†	0.05	30	0.05	30	0.15	30
Detroit, Mich	0.08	12	0.12	12	0.35	12
Dodge City, Kans	0.07	7	0.11	7	0.27	7, 13, 14
Jupiter, Fla	0.35	5	0.65	5	1.10	5
Marquette, Mich	0.02	25	0.05	25	0.05	25
New York City	0.04	12, 21	0.07	12, 21	0.21	12, 13
New Orleans, La	0.10	5	0.15	19	0.25	19
Savannah, Ga	0.02	26	0.04	26	0.13	26
San Francisco, Cal	0.12	7	0.21	7	0.63	7
Saint Louis, Mo‡						
Washington City	0.02	23, 27	0.05	23, 27	0.22	23

*Total for month. †Record not complete. ‡Rain gauge not working.

The table shows that the greatest rate per minute for a five-minute period was .07, at Jupiter, Fla., 5th. The rate per minute for this period at the other stations given was, .024 at San Francisco, Cal., 7th; .02 at Cincinnati, Ohio, 12th; .02 at New Orleans, La., 5th; .016 at Detroit, Mich., 12th; .014 at Dodge City, Kans., 7th; .01 at Boston, Mass., 27th; .01 at Chicago, Ill., 30th; .008 at New York, N. Y., 12th and 21st; .004 at Marquette, Mich., 25th; .004 at Savannah, Ga., 26th; .004 at Washington, D. C., 23d and 27th. The greatest rate per minute for a ten-minute period was .065, at Jupiter, Fla., 5th. The rate per minute for this period at San Francisco, Cal., was .021, on the 7th; at Cincinnati, Ohio, .015, on the 12th; at New Orleans, La., .015, on the 19th; at Detroit, Mich., .012, on the 12th; at Dodge City, Kans., .011, on the 7th; at Boston, Mass., .008, on the 27th; at New York, N. Y., .007, on the 12th and 21st; at Chicago, Ill., .005, on the 30th; at Marquette, Mich., .005, on the 25th; at Washington, D. C., .005, on the 23d and 27th; and at Savannah, Ga., .004, on the 26th. The greatest hourly rainfall registered was 1.10, at Jupiter, Fla., on the 5th. At the other stations given the maximum rainfall for one hour was less than one inch.

SNOW (snowfall in inches and tenths).

Snow fell north of a line traced from extreme southern New Jersey westward to southeastern Ohio, thence northwest to central Michigan, thence southwest to northern Illinois, thence northward to northwestern Michigan, thence to northern Dakota, thence southward to extreme southern Kansas, thence southwest to central New Mexico, thence northward to southern Wyoming, thence to south-central Utah, thence to eastern California in about latitude north thirty-eight, and east of this line continued northward over eastern Oregon. The snowfall was unusually heavy for the season in central Colorado, southeastern Wyoming, and in Plumas Co., Cal., where it equalled or exceeded twenty inches, and amounted to twenty-four inches at Summit, Plumas Co., Cal., and Fort D. A. Russell, Wyo. In New England the snowfall was heaviest in New Hampshire, where it amounted to two inches at Berlin Mills and Manchester; in the middle Atlantic states the greatest fall reported was two inches at Nineveh, N. Y., and trace fell as far south as Washington, D. C. No snow fell in the Ohio Valley, except over the eastern half of Ohio, where trace was reported. The heaviest fall reported in the lower lake region was two inches at Pendleton Centre, N. Y., and in the upper lake region, 1.4 inches at Port Huron, Mich. No snow was reported in the upper Mississippi valley, and the heaviest fall in Dakota was 1.5 at Spearfish. Trace was reported in New Mexico as far south as Fort Stanton, and 4.2 inches fell at Beaver, Utah.

Snowfalls of one inch, or more, were reported as follows: *California*—Summit, 24; Cisco, 4.2; *Colorado.*—Husted, 23; Palmer Lake, 22: Boulder Cañon and Loveland, 18.5; Dolly Varden Mines, Elkhorn, and Fort Logan, 17; Climax, 16; Denver, Magnolia, and Eagle Farm, 14; Colorado Springs, 13.9; Moraine, 13.5; Villa Grove, 13; Georgetown, 12.5; Longmont and Leadville, 12; Aspen, 11.5; Cumbres, 11; Breckenridge, 9.5; Denver, J. College, 8.5?; Fort Collins, 8.5; T. S. Ranch, 8; Ranch near Como, 7.9; Agate and Cañon City, 7.5; Byers and Pueblo, 7; Rocky Ford, 6; Burlington, Grand Lake, and Thon, 5; Fraser, 4.5; Apishapa and Greeley, 4; First View, Las Animas, Fort Crawford, and Vilas, 2; Hardin, 1.5; Rifle Falls, 1.3; Aroya, Emma, and Julesburg, 1. *Idaho.*—Soda Springs, 5.5. *Kansas.*—Tribune, 8; Richfield, 6; Macksville and Offerle, 3; Bucklin, Bunker Hill, Dodge City, Lincoln, Quinter, and Winona, 2; Cawker City and Victoria, 1. *Michigan.*—Port Huron, 1.4. *Montana.*—Helena, 1. *Nebraska.*—Gering, 6. *Nevada.*—Fenelon and Halleck, 2.5; Golconda, 1.5; Battle Mountain, Beowawe, Tacoma, and Toano, 1. *New Hampshire.*—Berlin Mills and Manchester (1), 2; Antrim, Manchester (2), Walpole, and West Milan, 1. *New Jersey.*—Egg Harbor City, 1. *New York.*—Nineveh and Pendleton Centre, 2; Alfred Centre and Number Four, 1.5; South Kortright, 1.1; Cooperstown and South Canisteo, 1. *Oregon.*—Beulah, 2.5; Telocaset and Jordan Valley, 2. *Pennsylvania.*—Blue Knob, 3.6; Le Roy, 1.9; Coatsville, Gettysburgh, Huntington, Johnstown, and New Bloomfield, 1. *Dakota.*—Spearfish, 1.5. *Utah.*—Beaver, 4.2. *Vermont.*—Jacksonville, 1. *Wyoming.*—Fort D. A. Russell, 24; Cheyenne, 12; Camp Sheridan, 3.7; Lusk, 3; Camp Pilot Butte, 2.2; Fort Washakie (1), 2.3; Forts Laramie and Washakie (2), 1.5; Evanston, 1.

HAIL.

The more severe hail-storms of the month are referred to under "Local storms." Hail was reported during the month as follows: 1st, Mass., N. J., N. Y., Pa. 2d, Mich., Wis. 6th, Ohio. 7th, Miss., Nev., Ohio. 8th, Miss., Nev., N. Y., Pa. 9th, N. Y. 10th, N. Y., R. I. 11th, Iowa, Kans., Ohio. 12th, Ark., Ill., Ind., Kans., Ohio, Pa. 13th, Colo. 14th, Conn. 15th, N. J., N. Mex., Pa., Tenn., Tex., Va. 16th, Ohio. 18th, Nev., Pa. 21st, Kans., Me., Mass. 22d, Ark., Mo., N. C. 23d, Va. 24th, Mich., Nev. 25th, Ala., Miss., Nev., N. C. 26th, Ala., Cal., Miss. 27th, Ariz., Oregon, Utah. 28th, Miss., N. Mex., Wash. 29th, Ark., Kans., Miss., Oregon. 30th, Kans., Utah, Wis. 31st, Tex.

SLEET.

The more severe sleet storms of the month are referred to under "Local storms." Sleet was reported during the month as follows: 1st, N. Y. 5th, Mich. 6th, Mich., N. Y., Ohio. 7th, Mich. N. Y., Ohio, W. Va. 8th, Pa. 13th, Colo. 14th, Colo., Pa. 15th, Va. 21st, Dak., Mass., Mich. 22d, Dak., Pa., Wis. 23d, D. C., Md., Mich., Pa., Wis. 24th, Wis. 25th, Ala. 27th and 28th, Utah. 29th, Pa. 30th, Pa., Utah. 31st, Dak., Kans., Nebr., Utah.

WINDS.

The prevailing winds during October, 1889, are shown on chart ii by arrows flying with the wind. In New England, the Florida Peninsula, and the upper and lower lake regions northeast to northwest winds prevailed; in the middle Atlan-